THE PERIODICAL ADJUSTMENTS OF THE ANCIENT MEXICAN CALENDAR

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The interesting question as to whether and how the ancient Mexicans rectified their calendar has been resuscitated by a treatise recently published in the *Zeitschrift für Ethnologie* under the title "The rectifications of the year and the length of the Venus year," in which Prof. Edward Seler propounds the new hypothesis that the ancient Mexicans rectified their solar calendar by intercalating 10 days at intervals of 42 years, and their Venus calendar by the deduction of four days at the end of 55 Venus years, which are equivalent to 88 solar years.

On studying Professor Seler's treatise with the careful attention due to the work of such a well known authority, I was surprised to find therein certain inaccuracies which completely invalidate his theory. It is my duty to point out the following facts to my fellow workers, in order to avert the confusion which would inevitably arise if Professor Seler's new hypothesis were to obtain currency amongst Americanists.

In the opening sentences of his treatise, and in support of his statement that the oldest authorities explicitly deny that the Mexicans employed bissextile intercalation, Professor Seler quotes two passages from Bernardino de Sahagun's writings. In both of these the friar employs the expression "it is conjectured," and in one he adds, "it is probable that in the festival held at intervals of four years the Mexicans made a bissextile intercalation."

Commenting on this Professor Seler says: "Be it well noted that the friar does not say that he has heard this, he only says it is probable and it is conjectured. Therefore it is his own supposition only. And, in point of fact, no word of this occurs in the corresponding portion of the Nahuatl text."

A reference to the passages quoted from Sahagun's work shows that, in both cases, the point under consideration was the *time* or

period when an intercalation was made, and not the *fact* whether or not bissextile intercalation was employed by the Mexicans. Without entering into a discussion of the latter question, and merely for the purpose of accurately representing Sahagun's views, I refer the reader to the appendix to book IV of the latter's *Historia*, with which Professor Seler is naturally supposed to be familiar.

In the friar's long and vehement refutation, contained in this appendix, of what he terms the "falsehoods" written about the native calendar by a now unknown friar, the following sentence occurs:

"What he [the unknown friar] says about the bissextile intercalation not being used is also false, for in the count known as the real calendar they count 365 days and every four years they count 366 days by means of a festival that they hold for this purpose every four years."

It is evident that, had Professor Seler quoted the above explicit expression of opinion by Sahagun, he could hardly have emphasized, as he does, that the friar expressed only "a *supposition* which is, indeed, directly contradicted by other early authors."

The above sentence is followed by Professor Seler's statement that Motolinia, one of the first Spanish missionaries who went to Mexico, and after him Torquemada, *denied* that such an intercalation was used, and that the author of a chronicle written in Guatemala in 1683 maintained that neither the Mexicans or the Guatemalans employed bissextile intercalation. A translation is here given of this part of Professor Seler's text:

"Whereas the old authors are quite explicit on this point, later scholars sought to meet the difficulty by the assumption that an intercalation was made at the end of the 52-year period. There is no doubt that this theory is to be assigned to the learned Jesuit Don Carlos Siguenza, who lived in the second half of the 17th century.

"An intercalation of a whole week of thirteen days at the end of the 52-year cycle, or, as León y Gama prefers, an intercalation of 25 days at the end of the double cycle of 104 years, would have, in point of fact, pretty well rectified the calendar. Unfortunately this whole theory is an idle or fantastic speculation which is not proven by any old record; nor is it corroborated, so far as one can judge at present, by the picture-writings."

Professor Seler's positive assertions that the idea that the Mexicans intercalated 13 days at the end of the 52-year cycle was a fantastic theory assignable to Siguenza y Gongora, and that no old document recorded such an intercalation, prove that Professor Seler must be unacquainted with the contents of the invaluable work written in 1656 by Jacinto de la Serna, a native Mexican priest and doctor of theology, who was thrice elected rector of the University of Mexico and was renowned for his erudition and knowledge of the language and antiquities of the Mexicans.

As Serna's *Manual de los Ministros de las Indias*, including a treatise on the idolatries of the Mexicans, has been accessible to all students since 1899, when it was published in the *Anales* of the National Museum of Mexico, and as Professor Seler has quoted Serna's name in his publications, it appears inexplicable that he should ignore the testimony it contains in support of the fact that the Mexicans added 13 days to their 52-year cycle.

The circumstance, recorded by Beristain, that Siguenza y Gongora actually owned the original manuscript of Serna's great work, which had been written when Siguenza was but eleven years of age, likewise furnishes proof that instead of originating what Professor Seler designates as "a fantastic theory," the erudite Siguenza, and, after him, the most learned of Mexican scholars, accepted the following statements of Serna as authoritative:

"The century of these natives consisted of no more than fifty-two years. . . . At the end of these fifty-two years they intercalated thirteen days which did not pertain to any month or year and were designated by no name like all other days. These days were passed over as though they did not exist, and they were not adapted to any month or year whatsoever. These days were held as unfortunate, unlucky, and sad, and those persons who were born on one of them were considered unlucky. During these thirteen days, which constituted one of their weeks, all fires were extinguished throughout the lands subject to the Mexican monarchy. They named the element fire 'Xiuhtecuhtli,' or the Lord of the Year. During all of these days nothing was undertaken, no food which required cooking was partaken of and a general fast was observed. There existed a tradition according to which the world was to come to an end on one of these days, therefore throughout the thirteen days a general silence was observed and all watched during the night because it was thought possible that the next day might never break.

"On the thirteenth day, all persons being on the watch, the high priest lighted the new fire with fire-sticks, at sun-rise, on the summit of the hill of Ixtapalapa, and thence it was distributed throughout the land, with great rejoicing and shouting, and music made by their wooden drums, war drums, clarionets, rattles, and other instruments, the same ceremony being observed in all parts.

"These thirteen days were considered miserable because of the lack of fire, but on the day when the above ceremony was performed they began a new cycle, in such an ingenious manner, that, after the intercalated days had passed without having been designated by any sign or counted by signs like ordinary days, or dedicated to any of their gods, they began the new year and cycle in such a way that, if the preceding cycle had commenced with the sign One Calli, or house, the next cycle began with the sign One Tochtli, or rabbit. . . . And when this cycle ended, the same intercalation of thirteen days and the ceremony of lighting the new fire were observed, and they passed on to the third sign, Acatl, or cane, and then to Tecpatl, or flint. At the close of four cycles, or 208 years, they began again by One Calli. Thus the same combination of sign and number recurred only every four cycles."

In another portion of his work Serna states:

"After each year of 360 days, five days were intercalated, which were also called Nemontemi and were regarded as unfortunate . . . like the thirteen intercalary days of the year-cycle, but with this difference, that whereas the latter constitute a count of the bissextiles which were omitted in the cycle and were not numbered or marked by day-signs, the five days are those which are lacking in the [calendar] year, which did not contain more than 360 days."

The following important statement by Serna proves that a denial, such as made by Motolinia, Torquemada, and the chronicler cited by Professor Seler, that bissextile intercalation was used, does not necessarily constitute a denial that the thirteen-day intercalation was employed:

"*And although they had no knowledge of the bissextile year*, they attained the same result by means of the thirteen intercalary days added to each cycle. Thus there actually existed an accord between the native years and days with the years of the Church, but a divergence in the months, of which the Mexicans had eighteen." . . . (cap. VII, par. I.)

The above quotations from what is the clearest dissertation on the native calendar in existence, and which was written 27 years

before the Guatemalan chronicle classed by Professor Seler among the "old authorities," suffice to demonstrate the error of the latter's assertion that the 13-day intercalation is "not proven by any record" and is "a fantastic speculation assignable to the learned Jesuit Siguenza."

In my *Preliminary Notes on the Ancient Mexican Calendar System*, published five years before Serna's invaluable work appeared, I maintained that the 13-day intercalation at the end of each 52-year cycle was not only the natural outcome of the ingenious numerical system, but that its use explained and reconciled certain conflicting statements concerning the recorded names of the first days of the years. By means of tables I demonstrated, at that time, how the mere use of the 13-day intercalation caused each successive cycle to begin with the 20-day signs in rotation, the obvious result being the formation of a great cycle consisting of 20 cycles, each of these easily distinguished by the mere fact that it commenced with a different day-sign. Combined with the four year-signs in regular rotation, these day-signs afforded a means of distinguishing each cycle with a different name. It was my opinion then, as it is now, that the calendar system itself furnishes positive evidence that the 13-day intercalation at the end of the 52-year cycle was an all-important factor which was depended on by the ancient calendar makers when they planned their ingenious cyclical system.

It will be for my fellow-students to judge how much the internal evidence furnished by the calendar system itself and by Serna's testimony, which was adopted by the most learned of his countrymen, outweighs Professor Seler's new hypothesis that the Mexicans rectified their calendar by adding 10 days to 42 years.

Let us now examine Professor Seler's equally novel theory that the ancient Mexicans periodically adjusted 55 Venus years with 88 solar years by adding to the 88 years a Mexican year shortened by 4 days.

As by "Mexican year" Professor Seler designates the vague solar year of 365 days, the intercalation he suggests consists of 361 days and is intended to adjust 88 vague solar years to 55 Venus years.

Unlike Señor Paso y Troncoso, whose work he does not mention, but which contains the most painstaking and instructive study of the Venus year in connection with the Mexican calendar that has yet been published, Professor Seler makes no attempt to reconcile his theoretical adjustment with the fixed periods of the native calendar system. Had he more thoroughly tested the adaptabilities of the numerical system he would have found that a periodical adjustment of the count of vague solar years to Venus years could have been made in a manner even more simple than that suggested by Señor Troncoso, but as essentially the natural outcome of the native system itself.

Although I had not intended publishing it in advance of my work on the Mexican Calendar, I here submit a table which forms a part of the reconstruction of the calendar system which I made in 1892, the printed plates of which have since been preserved and exhibited in the Peabody Museum at Cambridge.

This table demonstrates the fact which Señor Troncoso first noted, and which Professor Seler has also recorded, how, owing to the numerical structure of the system, a series of synodic periods of Venus, each consisting of 583.92, or, roughly speaking, 584 days, inevitably produced or formed a cycle which completed itself only at the end of 65 Venus years, a 66th Venus year infallibly beginning on a day of the same sign and number as the first.

An interesting fact, which seems to have escaped Señor Troncoso, but which Professor Seler has observed, is that, throughout the 65-year cycle, the Venus years begin on only five out of the twenty days of the Mexican calendar. This natural result of the system associated a Venus cycle with five special day-signs and divided it into groups of five Venus years, equaling eight vague solar years.

Let us now see how simply the count of Venus years could have been adjusted to the count of vague solar years by merely adhering to the order of the calendar system itself.

Five Venus years, or 5×584 days, contain 2,920 days and are exactly equal to eight vague solar years of 365 days each. Therefore, at regular intervals of eight years the Venus and solar calendars met, with slight divergences—an interesting detail in connection

with the records that a special festival, associated with the planet Venus, was celebrated at intervals of eight years.

The complete Venus cycle of 65 synodic periods equals $2 \times 52 = 104$ vague solar years, as $65 \times 584 = 37{,}960$ days, and $104 \times 365 = 37{,}960$ days.

The system which produced the above harmonious results also furnishes the means of rectifying, in an equally harmonious and simple manner, not only the divergences between both counts, but those between the apparent movements of the sun and Venus, and their respective calendars. Notwithstanding Professor Seler's assertions to the contrary, Serna's authority, corroborated by other writers and by the system itself, establishes the fact that a group of thirteen days effectively adjusted the 52-year solar cycle.

Accordingly, a period of $2 \times 52 = 104$ vague solar years, equaling the cycle of 65 Venus years, received two intercalations of thirteen days each, which converted the 104 vague solar years into tropical years of 365.25 days, with a total number of 37,973 days.

On the other hand, at the end of the Venus cycle of 65 synodic periods, calculated as of 584 instead of 583.92 days, the Venus calendar was ahead of astronomical facts. As its progression amounted to about five days, it is obvious that, by simply deducting a five-day group from the end of the Venus cycle, i. e., by beginning the subsequent cycle five days earlier, a most simple and effective rectification of the Venus calendar was possible.

CYCLE OF PLANET VENUS

Consisting of $5 \times 13 = 65$ synodic periods of $583.92 = 584$ days each, and beginning on day 1 Cipactli.

Order of Venus Years.	Name of First Day of Each Year According to Mexican Calendar.													
1st.	Cipactli	1	9	4	12	7	2	10	5	13	8	3	11	6
2nd.	Coatl	13	8	3	11	6	1	9	4	12	7	2	10	5
3rd.	Atl	12	7	2	10	5	13	8	3	11	6	1	9	4
4th.	Acatl	11	6	1	9	4	12	7	2	10	5	13	8	3
5th.	Ollin	10	5	13	8	3	11	6	1	9	4	12	7	2

Note. — Five Venus years are equal to eight vague solar years:

$$5 \times 584 = 2{,}920, \quad \text{and}$$
$$8 \times 365 = 2{,}920.$$

Thus the Venus cycle equals $2 \times 52 = 104$ vague solar years, as $65 \times 584 = 37{,}960$ days, and $104 \times 365 = 37{,}960$ days.

The deduction of a five-day period from its end would effectively adjust the Venus cycle and cause the three cycles which follow to begin with the following sets of day-signs:

Cycle II.	Cycle III.	Cycle IV.
Cozcaquauhtli	Ozomatli	Ehecatl
Xochitl	Quauhtli	Miquiztli
Cuetzpalin	Quiahuitl	Itzcuintli
Tochtli	Calli	Ocelotl
Malinalli	Mazatl	Tecpatl

I pause here to point out the harmonious perfection of a system which permitted the progression of the Venus calendar and the retrogression of the count of vague solar years to be rectified by the simple deduction of an integral five-day group in one case and the addition of integral thirteen-day groups in the other.

It is interesting to observe, what I am the first to point out, the effect produced by the deduction of a five-day group at the end of each Venus cycle: it causes each of four successive cycles to be associated with a fresh set of five day-signs and starts a great cycle which completes itself only at the conclusion of the four cycles or after the $4 \times 5 = 20$ day-signs have served in turn as initial days, on exactly the same principle that is applied in the great solar cycle.

The great Venus cycle and the lesser cycles it embraces present a resemblance to an inner wheel revolving rapidly from left to right and an outer one turning more slowly in retrogressive motion. The latter is curiously matched by the retrogressive numeration recorded in the accompanying table, in which the 65 Venus years are seen to begin, in succession, on days the numbers of which run backward.

Evolved from the numerical system itself, the great Venus cycle, embracing $4 \times 65 = 260$ Venus years, thus accords perfectly

with the Tonalpoualli, the 260-day period or unit year which constitutes the basis of the system.

The harmonious working of this masterpiece of ingenuity is further demonstrated by the following detail: At the end of $4 \times 65 = 260$ Venus years, unless a different adjustment were made, the following cycle would begin on the days of the first group, but in a different order, the sign Acatl taking the lead, and so on until the $4 \times 5 = 20$ possible combinations were exhausted.

Another remarkable fact, which Señor Troncoso first noted, is that the total sum of intercalary days added to the $4 \times 13 = 52$ vague solar years, multiplied by 20, and forming the great solar cycle of 1,040 years, amounted to 260 days or a complete fundamental unit of the calendar system.

It would appear as though, when they devised the system based on the 260-day period, the calendar-makers must have had in view the simultaneous and ultimate formation of a great solar cycle of $4 \times 13 = 52 \times 20 = 1{,}040$ years rectified by 20 intercalations of 13 days each, forming a total sum of 260 days, and of a great Venus cycle of $5 \times 13 = 65 \times 4 = 260$ synodic revolutions, rectified by the deduction of 260 groups of five days each, or 1,300 days.

The close association of the five-day group with the Venus calendar, produced by its employment to rectify the apparent progression of the planet, suggests a possible explanation of the peculiarity that, in Maya and Mexican manuscripts, the sign of the planet Venus consists of five dots, which might also designate the groups of five Venus years equaling eight vague solar years.

It is unnecessary to discuss the striking contrast afforded by the simple and harmonious way of rectifying the calendar so clearly indicated by the system itself, and the complicated adjustment suggested by Professor Seler, which are not in harmony with the fixed order of the cyclical system, in which groups of 42 and 88 years and intercalations of 10 or 361 days or deductions of four days are absolutely out of order.

Before presenting the newly gained evidence furnished by an important document which has only just been published in full and which proves the astronomical origin of the 260-day period, I will make passing mention of the lunar count — the Meztlipohualli of

the ancient Mexicans, of which I submitted an experimental reconstruction to the Congress of Americanists at Huelva in 1892.

Fresh light is also thrown on this subject by Serna, who records that "the months were counted [by the Mexicans] like the Hebrews, from one neomenia to another, that is to say, from one appearance of the new moon to another . . . the word for month being the same as moon, thus a month was called one moon. It was by this count that the women counted the months of their pregnancy. . . In Oaxaca they had a count of thirteen months, with thirteen gods, one for each month."

I may here pause to point out that Serna's record that the lunar count was especially used by women in association with a nine-months' period is of particular significance and importance in connection with the 260-day period which, as I have noted elsewhere, accords with the period of human gestation. The view I expressed at Huelva, that the "Nine Lords of the Night" were the nine moons of the lunar year, is corroborated by Serna's statement that each of the thirteen moons of the Oaxaca lunar calendar had its special god. In the experimental reconstruction which I submitted at Huelva, the cycle formed consisted of $4 \times 13 = 52$ lunar years of 265 days each. In pointing out the advantages of the 265- over the 365-day period as a means of cursive registration of dates, I quoted the following opinion, concerning the merits of the 260-day period, expressed to me in a letter by Sir Norman Lockyer:

"The short year of 260 days is magnificent; it was the very finest thing they could have done. The lunation is 29.53 days and nine lunations are equal to 265.7 days. The short year, therefore, plus an epact of five days, equalled nine moons, so this brought the moon right, that is to say, the new moon (or the full moon, it is immaterial) would begin the second short year, third short year, and so on."

An objection to my reconstruction, raised by several fellow-workers, amongst them Dr Daniel G. Brinton, was that we had no documentary evidence to prove that such a lunar count was ever actually employed by the ancient Mexicans.

Serna, however, supplies us with the missing record of the existence of a lunar calendar. He records the names of the Mex-

ican "Nine Lords of the Night" and describes how a nocturnal calendar consisting of a count of nine night periods was employed. A simple verification of his statements concerning this nine-night count not only shows how intimately it was associated with the 260-day period, but furnishes further indications of the connection of the latter with the lunar count.

It is obvious that a 260-day or -night period embraces exactly 29 groups of 9 nights each, and also, approximately, 9 vague lunations of 29 days each.

Serna points out that the 259th night of a count of nine nights, beginning on the sign of the first Lord of the Night, infallibly falls on the sign of the eighth lord, and that, consequently, the 260th night corresponds to the sign of the ninth lord.

An experimental reconstruction of this basis further reveals that the 9 × 29 night periods contained in the Tonalpoualli would naturally begin on the signs of the Nine Lords of the Night in the following order of rotation:

29 day period No.	1	begins on the sign of the lord	1
"	2	"	3
"	3	"	5
"	4	"	7
"	5	"	9
"	6	"	2
"	7	"	4
"	8	"	6
"	9	"	8

The experimental addition of the five-day epact[1] which, as Sir Norman Lockyer has pointed out, would so effectively adjust the lunar count, initiates a cycle of 9 × 9 true lunar years of 265 days each, which begins as follows:

Year 1	on the sign of the lord	1
2	"	6
3	"	2
4	"	7

[1] The above adjustment of the 260-day period to astronomical facts by means of an epact of five days offers an exact parallel to the method which was actually employed in the case of the solar calendar, in which, as is well known, a five-day epact was added to the native year of 360 days in order to adjust the true solar year.

Year	5	on the sign of the lord	3
	6	"	8
	7	"	4
	8	"	9
	9	"	5

On the other hand, as the duration of nine lunations exceeds 265 days by exactly 17 hrs., 36 m., and 27 s., this excess, gradually accumulating, would soon cause a marked divergence in a prolonged count of successive periods of 265 days.

At the end of the $9 \times 9 = 81$ lunar years of 265 nights the retrogression of the lunar calendar would amount to 6 days, 14 hrs., 28 m., and 3 s. It is interesting, moreover, to note that the lunar cycle of $9 \times 9 = 81$ years exceeds in length the 52-year cycle of solar years of 365 days each by 6 years and 295 days; the latter period consisting of one 260-day period and 35 days (i. e., $4 \times 9 - 1$ day).

Postponing further discussion of the 265-day period, I now draw attention to the hitherto inedited treatise on the observation of the planet Venus by the ancient Mexicans, attributed to no less an authority than Friar Motolinia, which has just been published in the City of Mexico by Dr Nicolás León and in Paris by Señor Luis Garcia Pimentel.

The existence of this precious manuscript in the library of the late Joaquin Icazbalceta has long been known to scholars, but it was Señor Troncoso who first published, in 1883, fragmentary quotations from its pages. Since then Señor Alfredo Chavero and Professor Edward Seler have referred to it as a valuable source of information concerning the observation of the planet Venus by the Mexican priesthood.

The extracts printed below suffice to establish that an astronomical origin was assigned to the 260-day period by the Mexicans themselves. A table of the 260-day period accompanies the following text:

". . . here is explained the calendar or table of the star named Hesper, or, in the language of the Indians, Hueycitlalin (lit. the Great Star) or Totonametl (lit. the Shining One).

"The table given here can be designated as the calendar of the

Indians of New Spain, which they counted by a star which, in the autumn, begins to appear, toward evening, in the west with a clear and resplendent light. Indeed, those who have good eye-sight and know where to look for it can perceive it from mid-day on.

"This star is that we call Lucifer, etc. . . . As the sun goes lower and the days grow shorter the star seems to rise—thus each day it appears a little higher until the sun seems to reach it and pass it in the summer and spring when it sets with the sun and is visible through its light.

"And in this land the duration of time from the day when it first appears to when after rising on high it loses itself and disappears, amounts to 260 days, which are figured and recorded in said calendar or table. . . .

". . . the sign cipactli is the first day of the 260 and of all days. . . This count is not that of the course of the sun or the year, nor is it in respect to [the sun] that it is named and the signs exist, but it is from contemplation of the star. They named this count Tonalpoualli . . . which means the count of the planets or heavenly bodies which illuminate or give light, and by this they did not only signify the planet named Sun. . . . They also name the star Citlaltona, or 'the star of light.' . . .

"Next to the sun they adored and made more sacrifices to this star than to any other celestial or terrestrial creature. The astronomers knew on what day it would appear again in the east after it had lost itself or disappeared in the west, and for this first day they prepared a feast, warfare, and sacrifices. The ruler gave an Indian who was sacrificed at dawn, as soon as the star became visible. . . . In this land the star lingers and rises in the east as many days as in the west — that is to say, for another period of 260 days. Some add thirteen days more, which is one of their weeks.

"They also kept account, like good astrologers, of all of the days when the star was visible. The reason why this star was held in such esteem by the lords and people, and the reason why they *counted the days by this star* and yielded reverence and offered sacrifices to it, was because these deluded natives thought or believed that when one of their principal gods, named Topiltzin or Quetzalcoatl, died and left this world, he transformed himself into that resplendent star. . . . "

While it is obvious that the recorded observations as to the season and the period of visibility of the planet Venus, being necessarily transitory, apply only to one year, the above authoritative statements definitely establish not only that the 260-day period began with the

day Cipactli and was named the "Tonalpoualli" or "count of the celestial shining bodies," but that it was actually employed for the purpose of registering the apparent movements of the planet Venus.

Emphasizing again that the Tonalpoualli more closely corresponds to the duration of nine lunations than to the periods between the superior conjunction and digressions of the planet Venus, which is of 220 and not of 260 days as Motolinia records, I also wish to point out how admirably its numerical system is adapted to the registration of astronomical data in general. A striking instance of this adaptability is obtained if we experimentally register the synodic periods of the planet Mars.

According to Sir Norman Lockyer this planet takes 779.94 = 780 days to return to the same position with regard to the earth. If we fix on the day 1 Acatl of the Mexican calendar, for instance, as that on which the position of the planet is registered, and count 780 days, we ascertain that the 781st day falls again on the sign 1 Acatl and will continue to do so indefinitely. It can readily be seen how, in this case, a planet would come to be identified with a single day and sign until marked progression called for an adjustment and the adoption of a different sign.

It is of course impossible to enter here into what would necessarily be an extended discussion of the much debated question as to the date and day-sign on which the Mexican solar calendar began.

The publication of Serna's and Motolinia's important documents obliges students of the ancient Mexican calendar, myself included, to revise some of their conclusions and to abandon others which were reached prior to an acquaintance with these works.

The purpose of the present communication will be fulfilled if it directs the attention of American scholars to the important evidence which Professor Seler has ignored, and to the undeniably harmonious results which I have obtained by partly revised reconstructions on the lines indicated by Serna and Motolinia and confirmed by other early authors.

The following résumé of the main features of the reconstructed independent solar, lunar, and Venus year cycles are respectfully submitted to the consideration of my fellow-workers:

I

A count of solar years of 360 + 5 = 365 days subdivided into groups of 5, 13, and 20 days, forming lesser cycles of 4 × 13 = 52 years, each adjusted by an epact consisting of an integral 13-day group, and a great cycle of 20 × 52 = 1,040 years, at the end of which the total number of epacts employed for the purpose of rectifying the calendar amounted to 20 × 13 = 260 days, or one integral Tonalpoualli.

II

A nocturnal count of lunar years of 260 + 5 = 265 nights subdivided into 29 groups of 9 nights and embracing 9 lunations, forming a cycle of 9 × 9 = 81 lunar years, at the end of which retrogression would amount to 6 days, 14 hrs., 28 m., and 3 s.

It is obvious that *the addition of an integral 13-day group at the end of two lunar cycles* would have effectually adjusted the lunar calendar, a fact which is not only interesting *per se* but also in connection with the method of adjusting the solar calendar.

III

A count of Venus years of 584 days each, subdivided into 5-day groups, forming lesser cycles of 5 × 13 = 65 years, each adjusted by the deduction of one integral 5-day group; a great cycle of 4 × 65 = 260 years with a total deduction of 4 × 5 = 20 days, and a greater cycle of 5 × 260 = 1,300 years, with a total deduction of 5 × 20 = 100 days.